REFERENCE 34

# Preliminary Review of New Brunswick's Mineral Industry — 1988

New Brunswick Department of Natural Resources and Energy
Minerals and Energy Division

1989

This report has been prepared by:

Minerals and Energy Division
Department of Natural Resources and Energy
Province of New Brunswick

Hon. Morris Green, Minister

1989

REFERENCE 34

# PRELIMINARY REVIEW OF NEW BRUNSWICK'S MINERAL INDUSTRY 1988

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MINERALS AND ENERGY DIVISION
DEPARTMENT OF NATURAL RESOURCES AND ENERGY
NEW BRUNSWICK

1989

91-05180/

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# PRELIMINARY REVIEW OF NEW BRUNSWICK'S MINERAL INDUSTRY 1988

## EXPLORATION

Mineral exploration in 1988, as in the past several years, was largely aimed at finding gold. However, it will be evident from this review that there is an increasing interest in base metal deposits because of the improved prices for zinc, lead and, to a certain extent, copper. As well, prices are expected to remain stable for at least 4 to 5 years.

It is well known among the exploration fraternity that the Bathurst-Newcastle area of northern New Brunswick has a large number of base metal deposits, mostly found during the period 1952-1975. Wedge, Nigadoo, Brunswick No. 6, and Heath Steele were mined in the past; Brunswick No. 12 and Caribou are being mined (Figure 1, 1-5). Among the others that show promise are Restigouche, Half Mile Lake, and Murray Brook (Figure 1, 6-8).

All the deposits found to date intersect bedrock at surface and occur in a traceable, highly deformed sequence of Ordovician rocks that were formed in a back-arc volcanic setting. Because of the shallow nature of these deposits, they were relatively easy to find using the less expensive geophysical, geochemical, and geological methods. The challenge of the next wave of exploration in this region will be to find similar but blind deposits that are below the reach of present-day geophysical and geochemical techniques.

The detailed structural mapping of the host Ordovician volcanic-sedimentary pile, carried out during the 1984-89 Federal-Provincial Mineral Development Agreement, will serve as an excellent guide in the search for these very well hidden base metal deposits.

The search for gold was again most intense along the Bay of Fundy coast in southern New Brunswick and in the Riley Brook, Upsalquitch-Jacquet River, Millstream-Alcida areas (Figure 1), and at the eastern end of the Rocky Brook-Millstream fault system (Tobique-Chaleur Zone) of northern New Brunswick.

**Southern New Brunswick** The Hercynian conjugate thrust zone (Bay of Fundy gold belt, Figure 1) centred on Saint John once again received the most attention by explorationists and prospectors. The gold deposits are hosted by thrust slices of Precambrian volcanic and intrusive rocks and Paleozoic sedimentary rocks. Gold associated with pyrite occurs in intensely mylonitized zones associated with sericite, illite and carbonate alteration.

**Gordex Minerals Limited** reported the most impressive find of 1988, a 16.5 m intersection grading 19.5 g/t (0.57 oz./ton) gold in a drill hole put down 1 km north of its Cape Spencer mine (Figure 1, 9). This new discovery aroused the interest of **Cambior Inc.** who signed an agreement with Gordex to jointly assess its potential. Cambior can earn a 55% interest in the property by spending $1 500 000 and financing development and production. Drilling has indicated a zone of gold mineralization having a width of about 130 m and a strike length of 160 m. The zone is open at a depth of 90-210 m. Inferred reserves from previous drilling

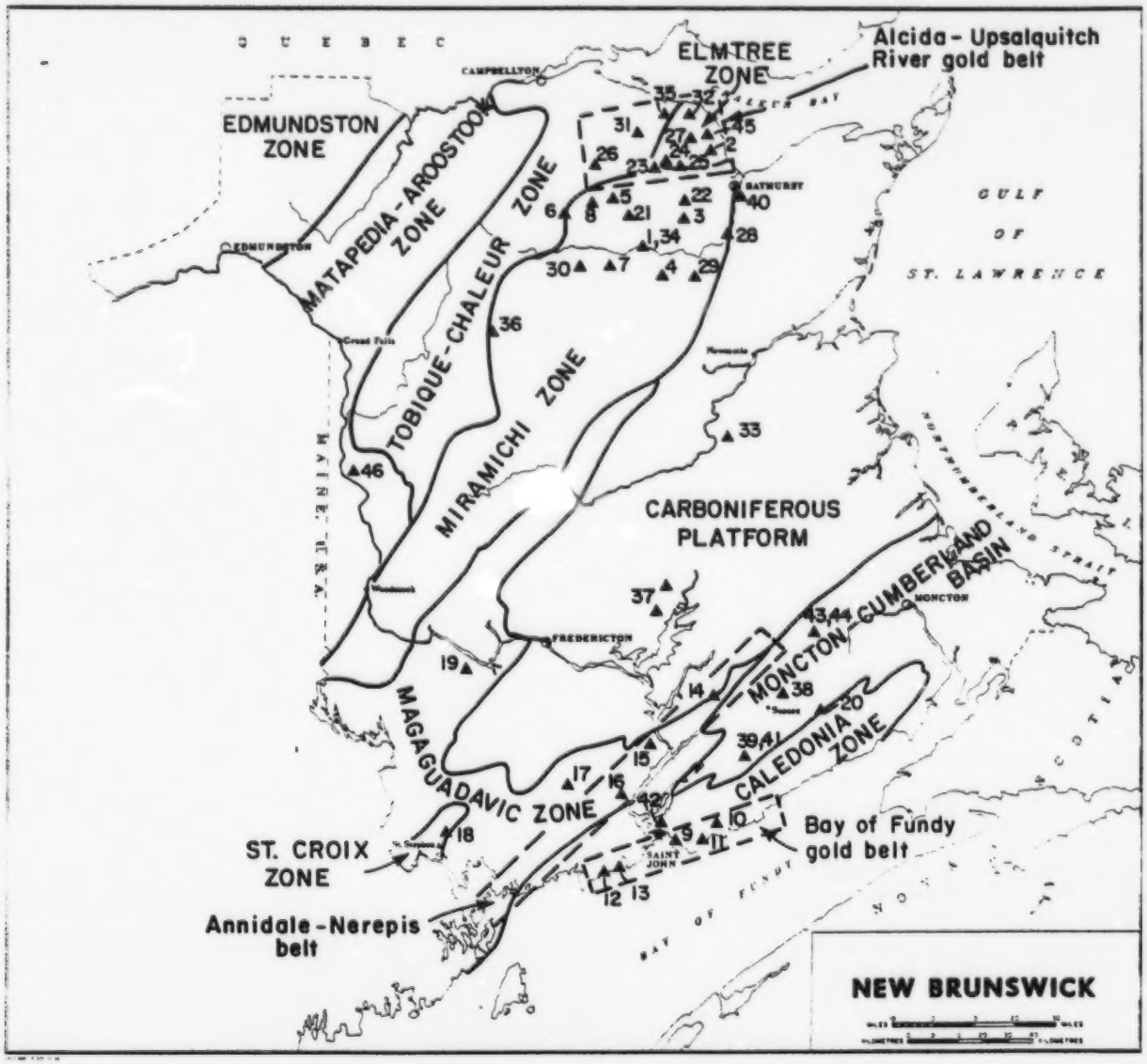


Figure 1. Tectonostratigraphic zones of New Brunswick and the location of properties explored or mined in 1988.

1. Wedge deposit (Cominco Ltd.) zinc, copper, silver
2. Nigadoo deposit (Shamrock Resources Inc.) base metals
3. Brunswick No. 6 (abandoned) and No. 12 mine (Brunswick Mining and Smelting Corporation Limited) zinc, lead
4. Heath Steele deposit (Heath Steele Mines Limited) zinc, lead, silver, copper
5. Caribou mine (East West Caribou Mining Limited) zinc, lead
6. Restigouche deposit (Marshall Minerals Corp.) zinc, lead, silver

7. Half Mile Lake deposit (Falconbridge Limited) zinc, lead, copper, silver
8. Murray Brook deposit (NovaGold Resources Inc.) base metals, gold, silver
9. Cape Spencer mine, claims (Gordex Minerals Limited and Cambior Inc.) gold
10. Claims, Cape Spencer area (Lacana Mining Corporation Limited, Neptune Resources Corp., Morton Gordon)
11. Claims, Cape Spencer area (Brunex Gold Resources Limited, Cuvier Mines Inc., Maritime Resource Research Ltd.)
12. Claims, Musquash Harbour area (Atlantic Goldfields Inc., Goldfluor Exploration Limited, Lombard Consolidated Resources Inc., Morton Gordon)
13. Claims, Musquash Harbour area (Kinbauri Gold Corp., Newbrun Resources Ltd., M. Gordon, P. Fenety)
14. Claims, Annidale (LAC Minerals Limited)
15. Claims, Evendale (Costigan Gold Corporation)
16. Claims, Nerepis (Atlantic Goldfields Inc., Lombard Consolidated Resources Inc.)
17. Claims, Pendar Brook (Brunswick Mining and Smelting Corporation Limited, Goldfluor Exploration Limited, Stratabound Minerals Corp.)
18. Claims, Rollingdam (Goldfluor Exploration Limited, Brunswick Mining and Smelting Corporation Limited, BP Resources Canada Limited, Corona Corporation)
19. Lake George mine (Dominion Explorers Inc.) antimony
20. Claims, Mechanic Settlement (Corona Corporation)
21. Claims, California Lake (Lacana Mining Corporation Limited)
22. Claims, Middle River (Granges Exploration Ltd.)
23. Claims, Millstream West (Acadia Mineral Ventures Ltd.)
24. Rocky Turn deposit (Acadia Mineral Ventures Ltd.) zinc, lead, silver
25. Claims, Rock Brook-Millstream area (Lacana Mining Corporation Limited)
26. Claims, Rocky Brook-Jacquet River (Lacana Mining Corporation Limited)
27. Alcida deposit (Lacana Mining Corporation Limited) gold
28. Key Anacon deposit (Noranda Exploration Company, Limited) sulphides
29. Captain North Extension (Stratabound Minerals Corp.) massive sulphides
30. Maliseet Mountain deposit (Granges Exploration Ltd.) copper, nickel
31. Claims, Falls Gulch-Jacquet River (NovaGold Resources Inc.)
32. Turgeon deposit (Heron Mines Limited) zinc, copper
33. Claims, Blackville (Atlantic Orebodies Inc.)
34. Canoe Landing Lake deposit (Gordex Minerals Limited) base metals
35. Nash Creek deposit (Falconbridge Limited) zinc, lead
36. Claims, Long Lake (Inco Gold Company)
37. Minto-Chipman area (N.B. Coal Limited) coal
38. Sussex area (Potash Company of America) potash
39. Salt Springs (Denison-Potacan Potash Company) potash
40. Bass River (Chaleur Silica Limited) silica
41. Cassidy Lake (Sussex Silica Inc.) silica
42. Brookville (Brookville Manufacturing Company Ltd.) limestone
43. Havelock (Havelock Lime) limestone
44. Havelock area (Lafarge Canada Inc.) limestone
45. Elmtree (Elmtree Resources Ltd.) limestone
46. White Mud Lake (Upper Kent Lime Works Ltd.) marl

were 300 000 t averaging 8.9 g/t (0.26 oz./ton) Au (uncut).

Initial studies indicated that the structure controlling the mineralization extended northeastward into the property held by **Mispec Resources Inc.** Reconnaissance drilling and trenching by Mispec resulted in the identification of several mineralized structures similar to those on the Gordex property. The success in the northeastern part of the Bay of Fundy gold belt has attracted other companies, such as **Brunex Gold Resources Limited, Cuvier Mines Inc., Lacana Mining Corporation Limited (Corona Corporation)**, and **Neptune Resources Corp.** (Figure 1, 10-11). One of the six holes drilled by Neptune intersected 2 m assaying 9.60 g/t gold.

In the southwest part of the Bay of Fundy gold belt, the active explorers are **Atlantic Goldfields Inc., Goldfluor Exploration Limited, Kinbauri Gold Corp.** and **Lombard Consolidated Resources Inc.** (Figure 1, 12-13)

In 1988 there has been a notable increase in exploration in the Annidale-Nerepis belt, which extends from Annidale (30 km northwest of Sussex) to St. George (Figure 1). **LAC Minerals Limited** is exploring a gold prospect associated with base metals and chromium mica in an alteration zone hosted by Silurian or older mafic volcanic rocks and pelitic metasediments that are intruded by a Devonian mafic-ultramafic complex (Figure 1, 14). Farther southwest, 25 km north of Saint John, **Costigan Gold Corporation** optioned a porphyry copper-gold prospect in the Evandale granodiorite; and near Nerepis, Atlantic Goldfields Inc. and Lombard Consolidated Resources Inc. are investigating several gold occurrences associated with a prominent northeast-trending fault (Figure 1, 15-16).

The Pendar Brook fault zone, along the northern contact of the Saint George Batholith, attracted the attention of **Brunswick Mining and Smelting Corporation Limited, Goldfluor Exploration Limited, Edgar Brown** and **Grand Empire Exploration Limited** (Figure 1, 17). Interesting features of this terrane are gold-bearing veins and silicified metasedimentary rocks associated with Devonian mafic and felsic intrusions.

Gold exploration returned to the Rollingdam area in the southwest of the Province following the publication of the results of a till geochemical survey by the New Brunswick Geological Surveys Branch. Gold-arsenopyrite-quartz-carbonate veins that are associated with the Honeydale fault system appear to be the source of the geochemical anomalies discovered in past compaigns. Interesting results reported by **Goldfluor Exploration Limited** include a trench sample assaying 87.8 g/t (2.56 oz./ton) gold, and a channel sample containing 50.4 g/t (1.47 oz./ton) gold over 0.76 m. Other companies searching this area are **Brunswick Mining and Smelting Corporation Limited, BP Resources Canada Limited,** and **Corona Corporation** (Figure 1, 18).

**Dominion Explorers Inc.** continued its search for additional antimony ore south of the Lake George mine (Figure 1, 19), and has outlined part of a gold-bearing skarn stockwork within the mine workings.

**Corona Corporation** is continuing its exploration of the Mechanic Settlement platinum-palladium prospect approximately 30 km east of Sussex in southeastern New Brunswick (Figure 1, 20). This occurrence, discovered by prospector Robert Baxter, is associated with a Pre-

cambrian peridotite.

**Northern New Brunswick** As in 1987, the most exploration occurred in the Tobique-Chaleur Zone, underlain by Silurian and Devonian volcanic and sedimentary rocks, and the Elmtree Zone, underlain by Ordovician sedimentary and ophiolitic volcanic and intrusive rocks. The features of interest are gold-bearing, fossil, epithermal systems in fractured Ordovician, Silurian, and Devonian rocks with or without associated mafic and felsic intrusions. Although it has been recognized for many years that late Paleozoic epithermal systems are also present in the Tetagouche Group (northern Miramichi Zone), explorationists were slow to investigate their potential. Some years ago, **Lacana Mining Corporation Limited** discovered a silver-bearing fracture system northwest of California Lake (Figure 1, 21). Work by **Brunswick Mining and Smelting Corporation Limited** suggests that they have found a southeastern extension of that zone. Farther south in the vicinity of Slacks Lake, **Acadia Mineral Ventures Limited** outlined an antimony-gold prospect in a late fracture system. **Falconbridge Limited**, in association with Acadia Mineral Ventures Limited and **Seabright Explorations Inc.**, has drilled seven holes to investigate the occurrence, but has not released the results. More recently in the Middle River area (Figure 1, 22), prospector **Claude Willett** found a gold prospect in silicified and sericitized Ordovician siltstones near a contact with mafic lapilli tuff. Twenty drill holes have tested this prospect (now under option to **Granges Exploration Ltd.**); the best results were 7.7 g/t (0.225 oz./ton) gold over 2.7 m and 6.2 g/t (0.18 oz./ton) gold over 1.7 m.

By March 31, 1989, **Acadia Mineral Ventures Limited** will have spent nearly $3 500 000 on exploration in northern New Brunwick. The company has investigated several properties along the Rocky Brook-Millstream fault system. Approximately 15 000 m of drilling has been completed on a variety of targets. The best preliminary results appear to be from the Millstream west property (Figure 1, 23), where gold occurs in Ordovician siltstones in contact with a mafic dyke. Acadia and **Spartan Resources Inc.** are jointly exploring other properties in this region. Acadian and **Seabright Exploration Inc.** are assessing the Rocky Turn zinc-lead-silver sulphide deposit (Figure 1, 24) that was found 30 years ago by Anaconda. The deposit consists of approximately 180 000 t of reserves grading 7.0% zinc, 1.5% lead, 0.3% copper, and 78.86 g/t (2.3 oz./ton) silver. The work to date has involved induced potential geophysical and soil geochemical surveys along the so-called favourable contact west and southeast of the deposit. Sulphide float found during the survey assayed 7% lead-plus-zinc, and 620 g/t (20 oz./ton) silver.

**Corona Corporation** (formerly Lacana Mining Corporation) in association with **Exador Resources Inc.** (a subsidiary of Canacord Resources Inc.) trenched and drilled gold-silver targets on its Rocky Brook-Millstream property (Figure 1, 25). The best intersections were 3 m assaying 155 g/t (5 oz./ton) silver and 9 m grading 1.0 g/t (0.03 oz./ton) gold.

Corona Corporation drilled 14 holes in its Rocky Brook (Jacquet River) gold property to test geophysical and geochemical anomalies (Figure 1, 26). Results were not available at the time of writing.

Other claim groups investigated include the Upsalquitch and California Lake groups.

Corona's most important find so far, the Alcida (Elmtree) gold deposit (Figure 1, 27), was tested to a vertical depth of 244 m by four drill holes funded under the Mineral Investment Stimulation Program (MISP). MISP is supported by Federal government funds administered by the Province. Reserves for the Alcida deposit are approximately 300 000 t grading 5.1 g/t (0.15 oz./ton) gold.

**Noranda Exploration Company, Limited** assessed several gold and base metal prospects in a variety of terranes. Gold targets were drilled in the Nigadoo River, Millstream River, Stephens Brook and Upsalquitch Forks areas.

The Half Mile Lake sulphide deposit continues to be of interest (Figure 1, 7). At least 18 holes (funded by Brunswick Mining and Smelting Corporation Limited) have been drilled in the down-dip part of this zinc-lead-copper-silver deposit. The average length of drill holes is 766 m. The deposit was originally discovered in the mid-1950s by Texas Gulf Sulphur Company. The near-surface part of the deposit is owned by **Falconbridge Limited.**

Noranda drilled three holes to test a possible extension of the Key Anacon sulphide deposit (Figure 1, 28) under the Carboniferous cover and continued exploration in the vicinity of other base metal sulphide deposits, viz., West Wedge-White Birch Lake (2 drill holes), Coldbrook (5 drill holes), Flat Landing Brook (2 drill holes) and Nine Mile Brook.

**Brunswick Mining and Smelting Corporation Limited** (64% Noranda Inc.) completed an $8 000 000 study of the Stratmat-Heath Steele sulphide deposits (Figure 1, 4). Exploration on the Stratmat Zone outlined 1 000 000 t grading 8% zinc, and 3% lead. This tonnage combined with that of the Heath Steele B zone (2 300 000 t grading 9% zinc-plus-lead) and that of the E zone (1 000 000 t containing 9% zinc-plus-lead), may prove to be economic feed for the idle Heath Steele mill.

**Stratabound Minerals Corporation** is assessing two massive sulphide prospects. Trenching and drilling on the Captain North Extension deposit (Figure 1, 29) served to substantiate the results of previous work by the South Bathurst Joint Venture who discovered the prospect in the late 1970s. The deposit comprises approximately 181 000 t grading 8.38% zinc, 3.44% lead, and 119 g/t (3.48 oz./ton) silver. Trenching also was carried out on the Taylor Brook sulphide prospect, found in the late 1970s by Consolidated Morrison Exploration.

**Granges Exploration Ltd.** continued to outline the extent of the Maliseet Mountain copper-nickel prospect (Figure 1, 30). Seven holes were drilled in 1988 with the best reported intersection being 9.15 m grading 1.19% Ni and 1.28% Cu. Electromagnetic targets on Granges' Roger Lake group proved to be graphitic sedimentary rocks.

**NovaGold Resources Inc.** established itself in the Province by acquiring several claim groups in northern New Brunswick. The company spent a substantial amount of money on its Falls Gulch (Jacquet River) claim group (Figure 1, 31). The gold-oriented targets were outlined by geophysical and geochemical surveys and were tested by six drill holes. To date, no results have been released.

**Shamrock Resources Inc.** continued its assessment of the Nigadoo base metal mine (Figure 1, 2). The

work included a review of tonnage and grade figures as calculated from previous drilling.

**Heron Mines Limited** drilled ten holes in the Turgeon zinc-copper sulphide prospect near Belledune (Figure 1, 32). This Cyprus-type sulphide deposit is estimated to contain 1-2 000 000 t of reserves grading 4% zinc and 1.5% copper.

**Atlantic Orebodies Inc.**, funded by Acadia Mineral Ventures Limited continued its quest for base metal deposits in the Carboniferous of northern New Brunswick. Two drill holes have now been completed and a third started on the company's concession, which covers parts of Gloucester and Northumberland counties. In 1988, two holes were drilled near Blackville (Figure 1, 33), the first passed through 538 m of Carboniferous rocks and penetrated 61 m of pre-Carboniferous gabbro, the second hole had reached 457 m at the end of 1988.

**Gordex Minerals Limited** has optioned the Canoe Landing Lake massive sulphide deposit (Figure 1, 34) from Robert Stairs and is planning a drilling program early in 1989. The geological reserves are approximately 20 000 000 t of low grade zinc-lead.

**Cominco Ltd.** is re-examining the Wedge base-metal sulphide deposit (Figure 1, 1) that produced approximated 1 500 000 t of zinc-copper-silver ore in the mid-1960s. It is hoped that geophysical surveys may indicate new drilling targets on the property.

**Falconbridge Limited** drilled six holes in the Nash Creek zinc-lead prospect approximately 35 km north of Bathurst (Figure 1, 35). The deposit occurs within undeformed altered Devonian basaltic lavas and tuffs intercalated with limestone.

**Inco Gold Company** explored its Long Lake claim group (Figure 1, 36). **Rio Algom Exploration Inc.** acquired claims in the Jacquet River area.

Other companies active in New Brunswick are: **J.D. Irving Limited, Shediac Bay Resources Inc., Mascarene Mines Ltd., Sullivan Resources Inc., Rex Silver Mines Ltd., Highbourne Exploration Ltd., Appalachian Resources Inc., U.S. Borax Inc., Northeast Exploration Services Limited, Lone Pine Exploration Ltd., Sharpe Energy and Resources Limited,** and **Tintina Mines Limited.**

**Mineral Lands** The total number of claims staked in 1988 was 6936, up 53% from the 1987 total of 4494 (Figure 2, Table 1). At the end of the year, there were 15 899 claims, 40 mining licences (1795 claim equivalents) and 8 mining leases (696 claim equivalents) in effect, which represent a total claim equivalent of 18 390 (up 21% from 1987). Exploration expenditures obtained from assessment reports submitted in 1988 amounted to approximately $8 400 000 (Table 1). It is believed that twice this amount was actually spent.

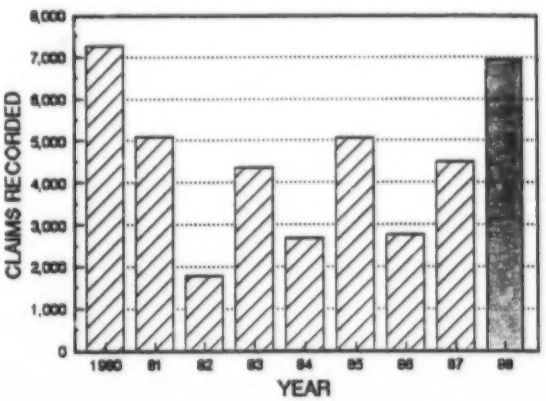


Figure 2. Mineral exploration claims recorded, 1980 to 1988.

TABLE 1. MINERAL LANDS AND EXPLORATION STATISTICS, 1988

| MINERAL LANDS STATISTICS | No. | Claim Equivalent | Hectares | % Inc. Over Prev. Year (Decrease) |
|---|---|---|---|---|
| Prospecting Licences Sold* | 195 | - | - | (10) |
| Claims Recorded | 6 936 | 6 936 | 110 976 | 53 |
| Claims Renewed | 8 211 | 8 211 | 131 376 | 36 |
| Claims Expired | 1 839 | 1 839 | 29 424 | (38) |
| Claims in Effect** | 15 899 | 15 899 | 254 384 | 51 |
| Mining Licences Renewed | 40 | 1 795 | 28 720 | (64) |
| Mining Licences Expired | 67 | 2113 | 33 808 | 347 |
| Mining Licences in Effect** | 40 | 1 795 | 28 720 | (64) |
| Coal Licences in Effect** | 1 | 5 818 | 93 088 | 0 |
| Potash Leases in Effect** | 3 | 2 355 | 38 130 | 0 |
| Other Leases in Effect** | 8 | 696 | 11 136 | 59 |
| Total Claims and Claim Equivalents in Effect** | 26 664 | 26 664 | 426 624 | 14 |
| Oil-Gas Licences | 2 | - | 66 072 | (91)*** |
| Oil-Gas Leases | 4 | - | 13 289 | 84*** |
| Bituminous Shale Licences | 1 | - | 8 998 | 0 |
| Bituminous Shale Development Permits | - | - | - | - |
| Bituminous Shale Leases | 1 | - | 1 439 | 0 |
| Underground Storage Licences | - | - | - | - |
| Underground Storage Leases | - | - | - | - |
| Quarry Permits | 366 | - | - | 5 |
| Quarry Leases | 7 | - | 481.27 | 0 |
| Peat Licences (issued 1988) | 3 | - | 1 174 | (34)*** |
| Peat Leases** | 26 | - | 10 573 | 9*** |
| Potash Exploration Reservations | - | - | - | - |

| EXPLORATION STATISTICS | Number | Depth (m) | Value ($) |
|---|---|---|---|
| Assessment Reports | 148 | | |
| Exploration Reported | | | 8 400 000 |
| Drilling | 376 holes | 32 868 | 2 032 826 |
| Potash Exploration | | | |
| Expenditure | | | - |
| Drilling | - | - | - |
| Oil-Gas Exploration | | | |
| Expenditure | | | - |
| Drilling | - | - | - |
| Bituminous Shale Expenditure | | | - |

Note: After July 6, 1986, mining licences no longer issued.

* Prospecting licences are now issued for life

** In effect at year's end

*** Based on number of hectares

February 1, 1989

Amendments to the Mining Act and Regulations are scheduled to be in effect by the summer of 1989.

## DEPOSITS BEING DEVELOPED

During the early part of 1987, Caribou New Brunswick Mining Limited applied for a mining lease for the property (Caribou, Figure 1, 5) previously owned by Anaconda Canada Exploration Ltd. The company's proposal is for a 2000 t/d cut-and-fill mine that will produce a bulk zinc-lead concentrate. The operation will expend $40 000 000 of investment capital and at full production will employ approximately 175 people.

Development of the property began late in 1987; work progressed well until early in 1988 when it became apparent that required equity financing for the project would not be forthcoming.

A concerted effort was begun by both the Provincial government and the company representatives to find other sources of financing for this portion of the project. A suitable investor was found and the required financing put into place after the Province of New Brunswick agreed to supply a loan guarantee. This action opened the way for Caribou to acquire suitable debt financing for the remainder of the development.

The delay in acquiring the needed financing deferred the start-up date by approximately four months.

Caribou has completed the construction of a dam for the tailings pond, carried out extensive underground definition drilling for mine layout, initiated stope development, and completed the expansion of the existing mill. After holding a public meeting (December 1987) concerning the environmental aspects of the proposed operation and after approval of the reclamation plan (October 1988), Caribou New Brunswick Mining Limited received its Mining Lease on October 28, 1988. A short time later the company changed its name to East West Caribou Mining Limited.

Mill start-up has been initiated and it is expected that the first bulk concentrate will be shipped out of the port of Belledune during the first week of February, 1989.

Northumberland Mines Limited had completed the majority of preliminary feasibility and government regulatory requirements for the Murray Brook property (Figure 1, 8) in 1987. An attempt to acquire equity financing was made late in 1987; however, following the October 19 stock market incident, investor confidence was low and the required financing could not be attained. This led to a merger of Northumberland Mines Limited and a Nova Scotia company, NovaGold Resources Inc. NovaGold has a proven record for being able to raise capital for mining projects and it was felt that this combination would allow the required financing to be put into place.

NovaGold received federal loan guarantees through the Atlantic Canada Opportunities Agency as well as interim financing from the Province of New Brunswick. It is understood that the required equity financing has been put into place through a $2 000 000 limited partnership offering. Development of the project will recommence in March of 1989.

The project has an approved reclamation program and has submitted a revised feasibility plan as part of its application for a Mining Lease. Work was undertaken during 1988 to upgrade roads into the property and to do on-site pre-

paratory work to facilitate construction.

NovaGold intends to follow Northumberland's plan to mine 1 500 000 t of gossan, grading 1.27 g/t (0.037 oz./ton) gold and 51 g/t (1.49 oz./ton) silver. Interest has also been expressed in the base metal content of the unweathered sulphide deposit. Production is expected late in 1989.

**Heath Steele Mines Limited** completed the Stratmat exploration programme during 1988 (see Brunswick Mining and Smelting Corporation Limited, p. 6), and followed that with a feasibility study on the economics of reopening the Heath Steele property (Figure 1, 4). Extensive work was carried out on the Stratmat deposit following the completion of a 2438 m (8000 ft.) exploratory decline. This included considerable underground drilling for deposit definition, followed by bulk sampling for metallurgical testing, as well as the development of a 13 600 t test stope to study potential ground conditions. The feasibility study for the project was completed at the end of 1988, which was followed by an application to the New Brunswick Department of Municipal Affairs and Environment for Environmental Impact Assessment (EIA) screening. The Boards of Directors of Brunswick Mining and Smelting Corporation Limited and Noranda Inc. are expected to make a decision on funding of this project early in 1989. If the decision is positive, the mine/mill is expected to operate at a rate of 2200 t/d and employ approximately 220 people. Capital expenditure would be approximately $5 000 000. The mill would process combinations of various ores from deposits in the area including Stratmat. The mine is expected to operate for a minimum of five years (see Brunswick, p. 6).

The Restigouche zinc-lead-silver deposit (Figure 1, 6), located near the Road to Resources approximately 80 km from Bathurst, was discovered in 1960. The property has had a number of owners since that time. In mid-1988, **Marshall Minerals Corp.** acquired the rights from Placer Development Ltd. To date, Marshall Minerals has carried out definition drilling to determine the open pit tonnage; in addition, several holes were drilled for metallurgical testing. The company recently announced that it had raised $2 000 000 in flow-through share funds to continue its assessment.

The geological reserves are calculated to be 2 300 000 t grading 6.55% zinc, 5.13% lead, 0.33% copper, 103 g/t (3 oz./ton) silver and 1.03 g/t (0.03 oz./ton) gold.

No definite production plans are in place at this time; however, it is expected that in 1989 a decision will be made concerning the development of the deposit.

## OPERATING MINES, WELLS AND QUARRIES

**Production Statistics** The value of New Brunswick's mineral production for 1988 was $831 055 000 (Table 2). This represented an increase of approximately 34% in the value of minerals produced (Figure 3). The major contributing factors for this increase are improved metal and potash prices and overall improved production from the operating mines.

The value of metals produced, $545 957 000 (Table 2), makes up the majority (66%) of total mineral production. Of the individual metals, zinc made the most notable improvement. It rose in value to

TABLE 2.
MINERAL PRODUCTION IN NEW BRUNSWICK, 1988

**Preliminary Estimate**

| METALS | Units | Quantity | Value ($) |
|---|---|---|---|
| Antimony | kg | — | 7 276 000 |
| Bismuth | kg | 180 000 | 2 770 000 |
| Cadmium | kg | 84 000 | 1 590 000 |
| Copper | kg | 9 607 000 | 30 847 000 |
| Gold | g | 74 000 | 1 273 000 |
| Lead | kg | 73 289 000 | 73 289 000 |
| Silver | kg | 202 000 | 49 896 000 |
| Zinc | kg | 230 125 000 | 379 016 000 |
| TOTAL | | | 545 957 000 |
| NONMETALS | | | |
| Gypsum | t | — | 19 000 |
| Peat | t | 214 000 | 18 292 000 |
| Potash | t | — | — |
| Silica | t | — | — |
| Salt | t | — | — |
| Sulphur (in smelter gas) | t | 94 000 | 10 616 000 |
| TOTAL | | | 205 124 000 |
| FUELS | | | |
| Coal | t | 545 000 | 33 880 000 |
| Natural Gas | $m^3$ | 1 000 000 | 14 000 |
| Petroleum Crude | $m^3$ | — | 13 000 |
| TOTAL | | | 33 907 000 |
| STRUCTURAL MATERIALS | | | |
| Clay products | t | — | 2 975 000 |
| Cement | t | — | 4 058 000 |
| Lime | t | — | — |
| Sand and Gravel | t | 10 300 000 | — |
| Stone | t | 2 960 000 | 16 280 000 |
| TOTAL | | | 46 067 000 |
| GRAND TOTAL 1988 (CDN $), preliminary | | | **$831 055 000** |
| GRAND TOTAL 1987 (CDN $) | | | **$622 231 000** |

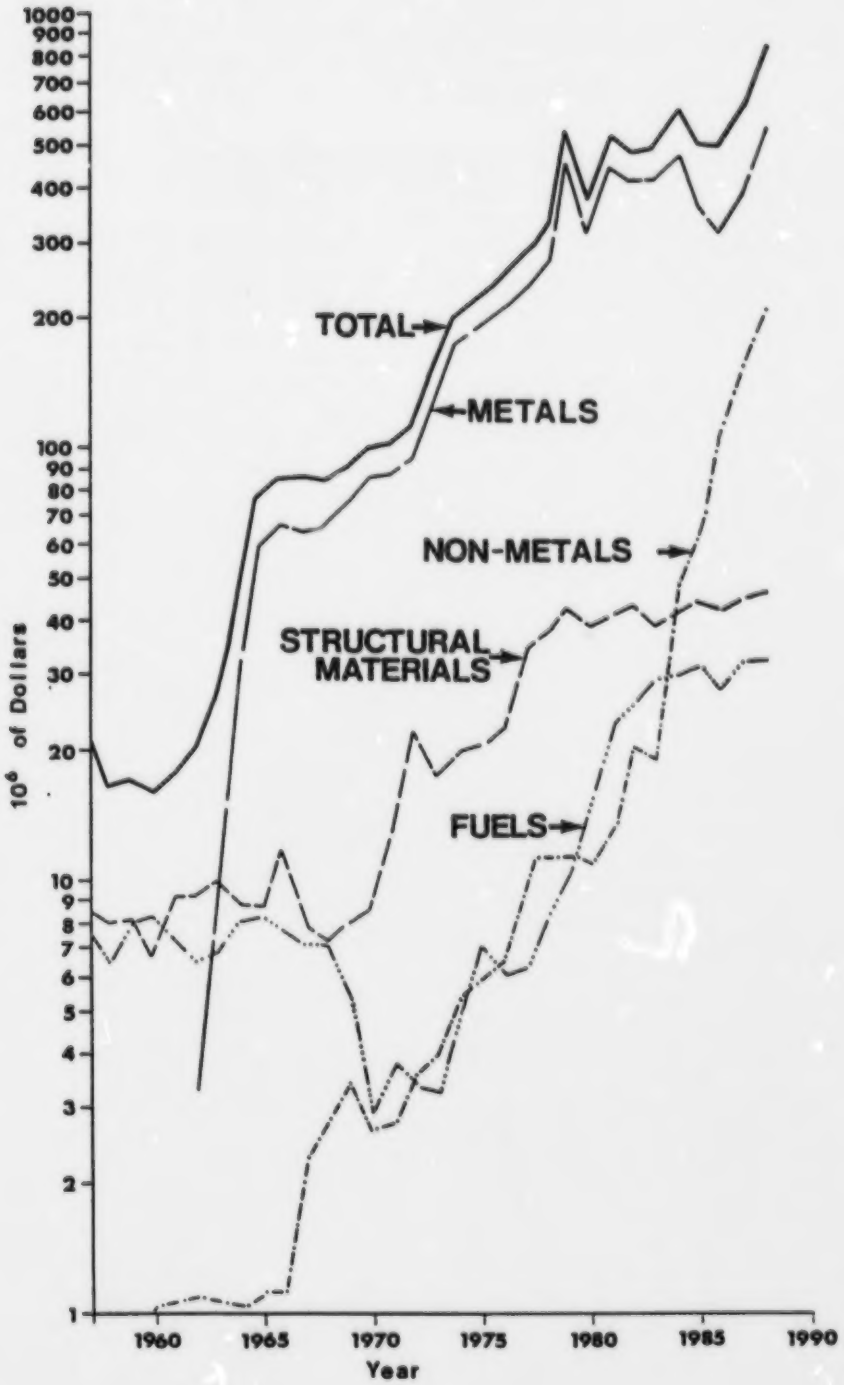


Figure 3. Value of mineral production in New Brunswick, 1957-1988.

$379 016 000, which represents 45% of the total value of minerals produced. Zinc prices for 1988 ranged from a low of $0.44 US to a high of $0.77 US per pound, an increase in value of 75%.

Lead is the second most valuable metal produced in the Province with a value of $73 289 000. Although the amount of lead produced had significantly increased in 1988, lower lead prices resulted in only a marginal increase in its production value. Similarly, the decrease in the value of silver offset the marked increase in production. Copper made the most significant gains in both value and production, with an overall increase in value of 76%. It contributed over $30 000 000 to the value of mineral production.

Antimony ($7 276 000), bismuth ($2 770 000), cadmium ($1 590 000) and gold ($1 273 000) all contributed significantly to the Province's overall metal output and it is noteworthy that cadmium, while not increasing in quantity, increased in value by 225%. This exemplifies the extreme changes that can occur in the metals market when demand exceeds supply.

In the nonmetals sector, potash is the major contributor. It experienced an increase in value of 49%, which can be directly attributed to higher prices and increased production from the Sussex area mines.

Other nonmetals such as peat and sulphur (from smelter gas) also contribute significantly to New Brunswick's mineral industry. Overall, nonmetals (including gypsum, salt and silica) represent 25% of the value of mineral production, or a total of $205 124 000 (Figure 3, Table 2).

Fuels contributed $33 907 000 (about 4%) to the total value of production (Table 2). Coal is the major contributor to this figure, although oil and natural gas wells are producing on a regular basis in New Brunswick.

Structural materials, consisting of cement, clay products, lime, sand and gravel, and stone, were valued at $46 067 000 for 1988 (Table 2). These materials literally provide the construction basis upon which industry can grow in the Province.

New Brunswick is a national leader in the production of antimony and bismuth. As well, the Province is second in the production of peat and potash, and third in zinc, lead and sulphur (from smelter gas).

**Metallic Minerals**

**Brunswick Mining and Smelting Corporation Limited** operates Canada's largest known zinc deposit (Figure 1, 3). Brunswick No. 12 is the world's largest zinc mine. The company experienced an out-standing year as the price of zinc, copper, and cadmium rose to remarkable levels compared to recent historical values. Because of these dramatic prices it is expected to be one of Brunswick's most profitable years in recent memory.

Employment at the operation remained relatively steady; labour unrest was at a minimum because the Company is in the middle of a three-year collective agreement with the United Steelworker's Union.

There were no extensive, unscheduled shutdowns in 1988 and production was comparable to 1987. The deepening of No. 3 shaft was completed in 1988, and a one-month shutdown will be required in July 1989 to re-rope the shaft. During that period ore will be hoisted on a limited basis from No. 2 shaft.

Zinc and bulk concentrate are shipped to foreign ports from

Brunswick's port facilities at Belledune, 30 km northwest of Bathurst. Lead concentrate is smelted at the Company's lead refinery also at Belledune. Federal government preliminary estimates indicate 73 289 000 kg of lead and 202 000 kg of silver were smelted during 1988, as well as significant quantities of antimony, bismuth, copper, and gold. Sulphur from smelter gas is also used to make suphuric acid, a key component for making diammonium phosphate fertilizer at the Company's adjoining Belledune fertilizer plant.

Reclamation of the No. 6 and No. 12 mine sites is progressing, with approximately 25 ha reclaimed in 1988. Sulphide waste material is also being placed in the flooded No. 6 pit to reduce oxidation. Although other environmental problems remain a concern at the mine site, the reduction of thiosalt generation is a priority.

**Dominion Explorers Inc. (Durham Mines Division)** continued to operate North America's largest and Canada's only primary producing antimony mine (Figure 1, 19). Dominion Explorers Inc. is a subsidiary of Landmark Corporation.

Production was down marginally from 1987's record-breaking performance, as was the price of antimony. The price did experience a slight rebound near the end of 1988 and the company is optimistic for 1989.

The workforce also decreased slightly from the previous year's level, mostly due to the completion of the shaft-deepening project.

Since the completion of that undertaking, mining operations have focused on the opening up of the new 389 m (1275 ft.) level where a stibnite vein averaging 5.68% Sb has been encountered over a significant strike length. During 1989, plans include the development of the 411 m (1350 ft.) level. No further work is scheduled for the gold-bearing zone, which is parallel to the main antimony orebody. The results of surface drilling (in excess of 4250 m) performed over the year are reasonably promising.

No other major changes are planned for the mine in the near future. Management is placing its emphasis on improved efficiency for the operation.

**Gordex Minerals Limited**, New Brunswick's only primary producer of gold, continued production in 1988. The mine is located at Cape Spencer, 48 km east of Saint John (Figure 1, 9). During the year, Gordex signed a formal option agreement with **Cambior Inc.** that will result in the initiation of a major exploration programme on claims adjacent to the existing operation (see Gordex Minerals Limited, p. 1).

Production at the mine site was up significantly in 1988 and it is expected to improve even more in 1989 as operating techniques become more refined. The mining operation ran from June to November and leaching will continue year round. The vat leaching process that was implemented in 1987 has proven quite successful and is now the accepted method of processing the ore. The carbon-in-pulp procedure used to extract the gold from the cyanide solution has also proved quite effective and high recoveries are being maintained.

Reserves on the existing mine site are down marginally from those of 1987; however, it is expected that the extensive exploration drilling program proposed by Cambior Inc. will indicate some promising results in 1989.

**Fuels** Production of coal from the Minto-Chipman area of the

Province (Figure 1, 37) increased marginally in 1988 to 545 000 t. **N.B. Coal Limited** continued to supply the N.B. Power generating facilities at Dalhousie and Grand Lake. Employment remains steady as do labour relations with the United Mine Workers of America.

Reclamation work continued on the strip-mined land in the area. In 1988, N.B. Coal Limited had reclaimed more land than had been stripped.

The environment continues to be a major concern, especially the Fire Road site where acid is produced from large amount of sulphide in the host rock. Continual treatment with lime is required to neutralize the acid discharge. Extensive hydrogeologic work has been done in the area to better define the problem and preliminary long-term solutions have been reviewed. It is expected that a permanent solution will eventually be attained.

**Industrial Minerals Potash Company of America (a Division of Rio Algom Limited)** operates the potash mine 5 km east of Sussex (Figure 1, 38). The mine and mill facility, which began operating in 1983, is unique in North America because all mill tailings are returned underground as backfill.

Since Rio Algom Limited purchased PCA early in 1986, it has committed more than $30 000 000 to improvements designed to bring rated capacity of the mine up to 635 000 t/a KCl. PCA has been working toward improving mill equipment uptime and boosting potash recovery rates.

The highly automated mill produces granular and standard potash that grade a minimum of 60% $K_2O$.

PCA, a major New Brunswick salt producer, sells more than 500 000 t of industrial salt each year.

Potash from the mine is loaded onto rail hopper cars and transported to the deep-water port-loading facility at Saint John, less than 70 km away. Major shipments were made to Western Europe, Latin America, and Asia.

The PCA mine, mill, port, and transportation infrastructure employs about 340 persons.

The **Denison-Potacan Potash Company** mine, located 25 km southwest of Sussex (Figure 1, 39), commenced production in July 1985, becoming the second potash producer in the Province. The mine is a joint venture of Denison Mines Ltd. (60%) and the Potash Company of Canada (Potacan) (40%), a company equally owned by Enterprise Minière et Chimique of France and Kali und Salz AG of West Germany. Denison is the development manager; Potacan is the exclusive sales agent.

About 400 people are employed at the mine.

In 1988, the company continued its effort to bring the mill up to its design capacity of 780 000 t $K_2O$.

A 20 km railway spur line, built by CN Rail, links the mine to the main Moncton-Saint John line, allowing rail shipment directly from the mine site to the port of Saint John.

The storage facility at the port has a capacity of 115 000 t. Rail off-loading and ship-loading facilities are shared with PCA. The port facility can accommodate ships of 35 000 t. Shipments of potash were sent to the USA, Latin America, and the Far East.

**Chaleur Silica Limited** continued to produce silica at a reduced level from a siliceous sandstone deposit at Bass River, about 6.5 km east of Bathurst (Figure 1, 40). Recently, the company has been acquired by **Elmtree Resources Ltd.**

The silica has been used as a fluxing agent in the lead smelter at Belledune. Sandblast sand and aggregate for low-alkali cement have also been produced.

Between 1976 and the end of 1987, about 350 000 t of silica have been produced. Until recently, the annual rate of production was about 50 000 t.

**Sussex Silica Inc.** continued to produce silica from a deposit near Cassidy Lake, Kings County (Figure 1, 41).

Production from this mine consists of lump silica (pebbles) and sand of various sizes. The lump silica is used in the manufacturing of silicon metal at Becancour, Quebec, and the coarse-grained sand is used in the manufacturing of silicon carbide. The finer sand is marketed as specialty products (sand-blasting material; filtration, tree nursery, and decorative sands), smelter flux, and for use in glass and fibreglass insulation.

Initial capacity of the Sussex Silica Inc. operation is estimated at 80 000 t/a. Recoverable reserves of silica are estimated to be a minimum 18 000 000 t.

At its Brookville plant in east Saint John (Figure 1, 42), **Brookville Manufacturing Company Ltd.** continued to produce the following products throughout 1988: agricultural dolomitic limestone, fertilizer filler, roofing granules, concrete and asphalt aggregate, driveway aggregate, road metal, and hardpack road subbase. Annual production over the past five years has ranged between 200 000 and 300 000 t.

**Havelock Lime**, a Division of Dickenson Mines Limited, operates a quarry and crushing plant 40 km west of Moncton, at Havelock, Kings County (Figure 1, 43). Through 1988, the company produced agricultural calcitic and magnesium limestone, industrial and chemical process stone, and crushed stone for various aggregate uses. The company is eastern Canada's only producer of calcined and hydrated lime.

Annual quarry output and crusher feed is approximately 300 000 t of stone. Capacity for crushing is about 280 t/h, for pulverizing is about 45 t/h and for calcining is 175 to 200 t/d.

The company has recently completed an expansion programme designed to increase its lime production capacity by installing a Fuller annular-shaft kiln, the first of its kind in North America. The new lime kiln has a capacity of 300 t of product per day.

**Lafarge Canada Inc.** has a quarry several kilometres east of Havelock in Westmorland County (Figure 1, 44). Cement has been produced at this site since 1952, but the prominence of the plant as a Maritime producer has steadily diminished since 1982 due to higher production costs and a shrinking market for cement products.

The recent decline in oil exploration (one of the main markets for Havelock specialty products), protectionism against foreign imports by the USA, and a significant slowdown in major construction projects in the Maritimes have had a devastating effect on the plant's ability to maintain a profitable operation.

A similar plant operated by the company at Brookfield, Nova Scotia, appears to be a more modern and efficient operation.

Specialty cement products have traditionally been produced in the Havelock area because of the unique properties of the limestone.

Despite attempts over the past few years by Canada Cement Lafarge

Ltd. to maintain its Havelock area plant as a grinding operation for imported Nova Scotia clinker, the current poor market conditions recently forced the company to reassess the viability of the operation. As a result, operations at the plant were suspended indefinitely in 1987. It is to be used only as a distribution point for the Nova Scotia products.

The company intends to continue the operation of two existing quarries as part of contract obligations with Dickenson Mines Ltd. (Havelock Lime), by which the company is to supply the Havelock lime plant with 300 000 to 400 000 t of raw stone each year. Lafarge also intends to produce aggregate for its subsidiary, Permanent Concrete Ltd.

**Elmtree Resources Ltd.** continued the operation of a quarry and crushing-pulverizing plant about 20 km north of Bathurst at Elmtree, Gloucester County (Figure 1, 45). The limestone produced (50 000 to 60 000 t annually) is sold primarily to the lead smelter at Belledune as a fluxing agent. The remainder is sold as aggregate, fertilizer filler, and agricultural limestone. The crushing and pulverizing capacity is sufficient to supply more than four times the current annual demand.

Reserves in the explored area of the operating quarry are sufficient for 5 to 10 years at the current rate of production. In addition, two deposits being developed have inferred reserves sufficient to ensure production for several decades.

**Upper Kent Lime Works Ltd.** maintained marl production from the bed of a small, partially drained lake (White Mud Lake) at Maplehurst near Upper Kent, Carleton County (Figure 1, 46). Annually, the company sells 1000 to 1500 t of marl to the region's farmers.

Preliminary figures indicate that peat shipments in 1988 totalled about 6 500 000 bale equivalents (225 000 t), an increase from 1987 and another record shipment level. Production in 1988 was affected by poor climatic conditions.

Sixteen companies were producing from twenty-two bogs and several bogs were being explored or being developed.

During peak production, approximately 850 people (including seasonal workers) were employed.

A preliminary estimate of 1988 production value is $27 000 000.

## ACKNOWLEDGEMENTS

The editor wishes to thank all staff members of the Minerals and Energy Division who contributed text and technical expertise toward the preparation of this report. Major contributions of text were made by J.L. Davies, A.A. Ruitenberg, S.R. McCutcheon, S. McEwan, and T.C. Webb. Information and statistics were also provided by E.V. Jackson, F.J. Edney, R. Phillips, Jacques Thibault, P.C O'Leary, and D.J.J. Carroll. Figures were drafted or updated by L.G. Johnson and T. Leonard. Karen Gallagher assisted with typing.

## SUMMARY

There has been a marked increase in the value of minerals produced in New Brunswick during 1988. The total value of minerals produced was $831 055 000, up approximately 34% over

the 1987 figure. This increase was the result of higher production and improved prices for some of New Brunswick's key minerals.

The most notable improvement was in the value of zinc concentrates, which are produced by Brunswick Mining and Smelting Corporation Limited. It rose in value to $379 016 000, representing 45% of total production value. The next most significant gain was in the value of potash, which increased 49% over that of 1987. This increase is directly attributable to higher potash prices and improved production from both mines in the Sussex area.

While lead and silver increased in quantity produced, they experienced downturns in prices from the previous year. The value of lead produced reached $73 289 000 and silver reached $49 869 000 (respectively, 9% and 6% of total production). Copper prices and production realized record increases over 1987 figures, accounting for $30 847 000 (4% of total production). Antimony ($7 276 000), bismuth ($2 770 000), cadmium ($1 590 000) and gold ($1 273 000) all contributed to the total value of metals produced ($545 957 000 or 66% of total mineral production).

Antimony was produced by Dominion Explorers Inc. at its Lake George mine, the largest primary producer of antimony in North America. The gold yield increased at New Brunswick's only producing gold mine at Cape Spencer. It is owned by Gordex Minerals Limited. Gold and antimony are also a significant byproduct of the Brunswick Mining and Smelting Corporation Limited No. 12 mine in the Bathurst area.

Potash made up most of the value of nonmetals produced in the Province but other nonmetals, such as peat and sulphur from smelter gas, also contributed considerably to the Privince's mineral industry in 1988. Nonmetals (including gypsum, salt and silica) represent 25% of the value of mineral production or a total of $205 124 000.

A further 4% is contributed to the total value by the fuel industry in the Province. Coal is the major contributor; however, oil and natural gas are still being produced in the Province on a steady basis.

Structural material, valued at $46 067 000, comprise clay products, cement, lime, sand and gravel, and stone. These commodities are produced at many locations throughout the Province and are the backbone of the construction industry.

It would appear that 1988 has been New Brunswick's most productive year to date. However, indications are that the

future could be even better. Brunswick Mining and Smelting Company Limited and Heath Steele Mines Limited have recently completed a feasibility study for reopening the Heath Steele mine and at this time it looks promising that it will proceed. Production from this mine would increase the amount of zinc, lead, copper, and silver produced in the Province by 20%. If plans are finalized, production could commence in late 1989.

East West Caribou Mining Limited has successfully commenced production at the Caribou deposit, previously owned by Anaconda Canada Exploration Ltd. The mine will be producing throughout 1989 at a rate of 2000 t/d. This also will represent a further 20% increase over existing base metal production in the Province. The first shipment of bulk zinc/lead concentrate is expected to leave the port of Belledune in early February of 1989.

The Restigouche base metal deposit is being drilled by Marshall Minerals Corp. to define the deposit and to outline reserves. Indications for mine development are promising.

Gold output should improve in 1989 as NovaGold Resources Inc. begins construction at its Murray Brook deposit. During 1988, Northumberland Mines Limited merged with NovaGold and after some unfortunate delays have managed to finalize the financing requirements for the project to proceed. Gordex Minerals Limited in partnership with Cambior Inc. continued to explore the Cape Spencer area. Initial drilling indicating further potential for development in the area.

In 1988, as in the past several years, mineral exploration has been directed at finding gold. Exploration expenditures of approximately $8 400 000 have been reported, though the actural amount spent in the Province may be twice that amount. Claim staking increased 53% over 1987, and the total number of claims and claim equivalents in effect was up 14%. As in 1987, the search for gold was most intense along the Bay of Fundy coast in southern New Brunswick, and in the Riley Brook, Upsalquitch-Jacquet River, Millstream-Alcida areas as well as at the eastern end of the Rock Brook-Millstream fault system (Tobique-Chaleur Zone) of northern New Brunswick.

It is anticipated that, with improved base metal prices expected to remain stable over the next 4 to 5 years, there will be an increase in interest in the Bathurst-Newcastle area, where there is a large number of known base metal deposits.